A Current Indicator for Open-wire Transmission Lines

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Using an ASTU

A loop, or dipole antenna fed with "open-wire" transmission line probably gives the amateur, with the usual space and height restrictions, one of the best all-round multi-band antennas available. Depending upon the antenna, and transmission line lengths, we may get, at the station end of the line, "current feed" (low impedance), or "voltage feed" (high impedance), or anything in between. Also, the impedance may be resistive, or resistive with a capacitive or inductive reactance component. Unless the impedance is outrageous, a good antenna system tuning unit (ASTU) can generally make such an antenna work well on just about any HF band.

Intuitively, for each band, we generally adjust the ASTU for lowest SWR in the coax cable connection between the radio and ASTU, and leave it at that. But this SWR reading does not tell us what is actually happening on the transmission line between the ASTU and antenna.

For comparison purposes, one each of the three most popular ASTU circuit configurations were built; a "Link-coupled Transmatch", an RSGB "Z-Match", and the ARRL's favourite; a "T-network Transmatch".

The system to be "tuned" to the various HF bands was a 160 metre dipole fed with about 10 metres of ladder-line. Each circuit was carefully adjusted for minimum SWR in the coax cable. Interestingly, for the same frequency and transmitter power level, the value of transmission line current (and hence, by reasonable assumption, RF power "up the stick") was different for each ASTU, even though the coax SWR was 1.0 in each case.

Line Balance

I'm not going to tell you which circuit appeared to give best results; that aspect has already been adequately thrashed out in this and other journals. And anyway, my ASTUs may not be as efficient as yours.

Rather, in addition to the SWR in the coax cable, we should also be interested in the relative value of current (or voltage) in each wire of the transmission line to the antenna. In this instance, we are not worried about the SWR on the open-wire (or ladder) line. It may be, and probably is, quite high. Losses are acceptably low however, because the dielectric is mainly air, and the conductors are low resistance copper. The wires are closely coupled, so if the current and voltage levels are the same in each wire (but opposite in phase), then line radiation will be minimal.

RF Ammeters

At low and moderate impedances, an RF ammeter in each wire of the line will show the relative value of current. Hopefully, if the antenna is supposed to be balanced, they should be equal, or nearly so. For a voltage, or high impedance feed, a small desk-lamp fluorescent tube placed across the open transmission line will glow (at about 10 W and above, depending on tube type). The tube's brightness makes a handy indicator of electric (voltage) field intensity.

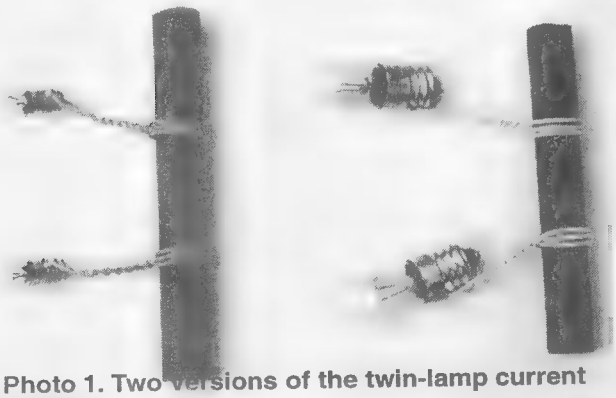

Photo 1. Two versions of the twin-lamp current indicator.

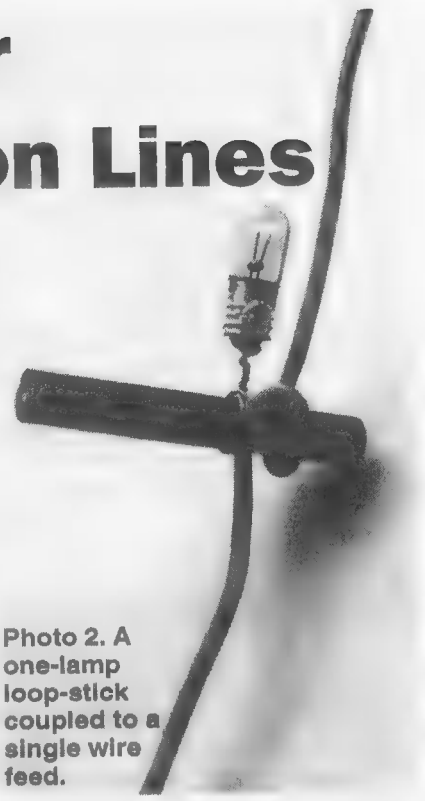

Photo 2. A one-lamp loop-stick coupled to a single wire feed.

RF ammeters are now rare items, particularly matched pairs. An unfortunate characteristic of the thermocouple type RF ammeter is that it is fairly easily overloaded to destruction. Many of the meters that I see at Hamfests, for instance, have "had-the-gong". You can easily check for their serviceability; turn the meter to and fro with a twisting motion. If the needle swings around freely and bounces off the stop, then the thermocouple is probably burned out. If the needle appears to be damped, the meter and thermocouple are probably good.

Substitute for RF Ammeters

Here are details of a simple device which makes a fair substitute for a pair of ammeters. Photo 1 shows two versions of a twin-lamp current indicator. The lamp type is not critical, but they must be identical. The small pea-lamps are 6 V/100 mA, #2721142 from Tandy, and the dial lamps are 6 V/150 mA, # 40 (generic). Each lamp is soldered to a three-turn hook-up wire link, which is wound upon a 70 mm (not critical) segment of ordinary loop-stick rod.

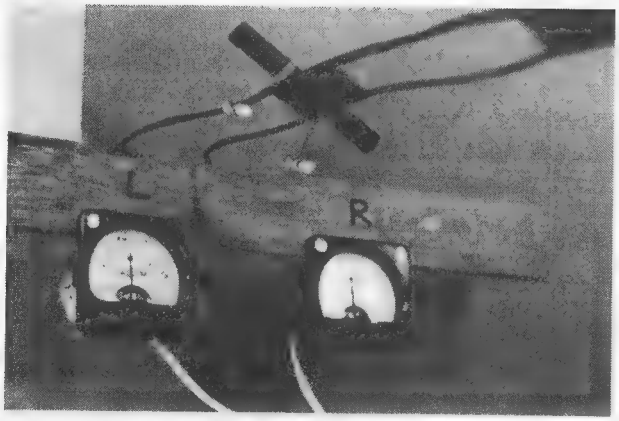

Photo 3. A one-lamp loop-stick coupled to a single wire feed.

In operation, the rod is placed, or attached (perhaps with a clothes peg) to the transmission feed line as shown in photo 2. Note how the link coils lie immediately adjacent to the outside of each wire of the line.

When the line is energised at moderate to high power (say, 100 W), the lamps should have equal glow, indicating that the current in each wire is the same. It may be necessary to move the loop-stick further along the line to find a higher current point.

The presence of the device introduces negligible disturbance or loss to the system, and does not alter ASTU settings. When making tests and adjustments, it will be found that smallest changes in current (and hence, resolution) may be observed when the lamps are at about half or 3/4 brilliance.

Photo 3 shows how a one-lamp loop-stick may be coupled to a single wire feed. Shown here is the station end of my inverted-L 160 metre ˇ wave antenna at the 50 W power level. At higher power levels it should not be necessary to coil the antenna wire around the loop-stick; simply place the lamp link coil adjacent to the wire.

References

1. *Radio Communication Handbook*, 6th edition, RSGB.
2. *Radio Handbook*, William Orr, Howard W. Sams & Co.
3. *The ARRL Handbook*, 74th edition.

The Fourteen Second Doughnut

— getting it "just right"

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WHEN IS ROUGH ENOUGH, good enough? Occasionally everyone must ask themselves this question when performing a task. The task can be anything, erecting a fence, making a meal, building a child's cubby house or merely driving a car. Can I do better? Do I need to do better? Differences are critical, and sometimes only a matter of personal asthetic.

We probably all know someone who has the 'She'll be right mate' attitude. Everything they do is completely casual and rough enough is always good enough. This is all fine and good, and may give that person more time for the better things in life, but would you let that person service the brakes on your car?

I have known perfectionists. Every coffee mug in the cupboard has a corresponding cup hook, their garage will have a shadow board so that each tool occupies a well defined niche. A lawn trimmed with scissors and a bed with sheets tight enough to bounce a ping-pong ball. They can spend so much time organising themselves that they will never actually do anything. Doing something may introduce unknown and uncontrollable circumstances. Something to be avoided at all cost.

So what is this all about? It's about getting the right mix. The art of looking at a task and deciding how good it has to be to achieve the best end. For example, you are building up a little circuit. You have the soldering iron out, you chase the parts around the benchtop blobbing solder on here and there and the circuit is complete. You test it and it works. Fine, that is all you need to do if it is going to remain in the bench. But if you decide to put the circuit in a car, bumpy roads are going to break this baby apart in no time! Back to the work bench. You re-do all solder joins, be careful, don't burn off all the flux and leave daggy bits jutting out when you pull the iron away, shorten all the wires, put strain relief on external cables and add four more mounting screws. All done.

Take another example. You are washing dishes (strictly hypothetical in my case) and you encounter a plastic dish with a bit of dried food stuck to one side. You scrub it hard but it stays. You get out the steel wool and it still won't come off. A trip to the workshop reveals that the chisel and the screwdriver only scratches this residue a bit. Finally the angle grinder restores the bowl to its pristine condition.

Upon your return, your spouse says "Ahh, I've been looking for that", fills the bowl with mince and gives it to the dog. Meanwhile you realise that you've missed the first twelve minutes of a *Yes Prime Minister* episode you've been dying to see all week.

How good something has to be is the hidden variable. The next time you embark upon a project and you are figuring out shapes, size, colour, location etc, stop and think about how good it has to be. Keep the project simple and you may have time left over to read a book, watch TV, or perhaps slip in an extra project. Failure to spend enough attention to detail might mean that your assets and possibly even your life are at risk.

Oh yeah. The fourteen second doughnut. Occasionally I spoil myself with the odd pineapple doughnut. The problem is that if served cold, they are hard, greasy and stick to the roof of the mouth. The modern microwave oven is a godsend for us doughnut eaters. But be warned, if served too hot, doughnuts become limp and scalding.

In a 600 watt oven, fourteen seconds is just right.